Solution for $1(b)$: Let X_n be the set of all arrangements satisfying the given condition. For $n \geq 3$, I define here a bijection f from $X_{n+1} \backslash X_n$ to X_{n-1}(where the set $A \backslash B := \{x \in A : x \notin B\}$) by $f : a \mapsto a \backslash \{n+1, n\}$, i.e., for any arrangement $a \in X_{n+1}$ but not in X_n, we map it to an arrangement in X_{n+1} by deleting the positions n and/or $n+1$ if they are inside a.

Let's see how to show f is actually a bijection. Let a be an arrangement in $X_{n+1} \backslash X_n$. If $n \in a$, then 1 must also be in a, otherwise $a \in X_n$. If $f(a_1) = f(a_2) = b$, then a_1, a_2 must be $b \cup \{n\}$ and $b \cup \{n+1\}$ respectively. This is impossible, since then 1 must be inside b(for $n \in b \cup \{n\}$) and $b \cup \{n+1\}$ can't contain both 1 and $n+1$. Thus f is injective.

To see f is surjective, we let b be any arrangement inside X_{n-1}. If $1 \in b$, then $n-1 \notin b$(since $n \geq 3$) and hence $b \cup \{n\}$ is inside $X_{n+1} \backslash X_n$ and $f(b \cup \{n\}) = b$. If $1 \notin b$, then $b \cup \{n+1\}$ is inside $X_{n+1} \backslash X_n$ and $f(b \cup \{n+1\}) = b$. Hence f is surjective and so it is a bijection.

Let α_n be the number of elements in X_n, from above argument, we have $\alpha_{n+1} = \alpha_n + \alpha_{n-1}$. Here I give a *cheating* way to show that $\alpha_n = F_{n+1} - F_{n-3}$ for F_n the Fibonacci number. Let $\beta_n = \alpha_n - F_{n+1} + F_{n-3}$. One can easily verify that $\beta_0 = \beta_1 = \beta_2 = \beta_3 = 0$. However, $\beta_{n+1} = \beta_n + \beta_{n-1}$ for $n \geq 3$, hence $\beta_n \equiv 0$ for every n and $\alpha_n = F_{n+1} - F_{n-3}$.